

WHAT IS CLAIMED IS:

1. A video encoding apparatus to encode a video,  
comprising:

an input picture module configured to receive  
5 an input picture;  
a memory to store a reference picture;  
a motion vector detection module configured to  
detect a motion vector of the input picture in units  
of a macroblock by block matching referring to the  
10 reference picture; and  
a predictive encoding module configured to  
perform forward predictive encoding and bidirectional  
predictive encoding in units of a macroblock using the  
motion vector and the reference picture, to generate  
15 a forward predictive encoded picture and at least one  
bidirectional predictive encoded picture which is  
inputted between the forward predictive encoded picture  
and the reference picture, the predictive encoding  
module skipping a macroblock of the forward predictive  
20 encoded picture in a variable length encoding when  
a correlation between the macroblock of the forward  
predictive encoded picture and macroblocks of the  
bi-directional predictive encoded picture and the  
reference picture which are located at the same  
25 position as that of the forward predictive encoded  
picture is high.

2. The video encoding apparatus according to

claim 1, which includes an orthogonal transformation module configured to subject each macroblock to orthogonal transformation and quantization to generate quantized orthogonal transformed coefficients, and  
5 wherein the predictive encoding module skips macroblocks of the forward predictive encoded picture that satisfy following conditions:

10 (a) forward motion vectors of the macroblocks of all bidirectional predictive encoded pictures using the reference picture which is the same as that used for the forward predictive encoded picture are 0, and

15 (b) matching residuals with respect to the macroblocks of all the bidirectional predictive encoded pictures that are at the same position are not more than a threshold,

3. The video encoding apparatus according to claim 2, wherein the predictive encoding module performs a forward motion vector detection of each of the macroblocks of all bidirectional predictive encoded pictures subjected to the forward motion vector detection by using the reference picture, before a variable length encoding of the macroblock of the forward predictive encoded picture that is located at the same position as those of the bidirectional predictive encoded pictures.

25 4. The video encoding apparatus according to claim 1, wherein the motion detection module carries

out a forward motion vector detection of the macroblocks of all bidirectional predictive encoded pictures that are located at the same position as that of the reference picture before variable length encoding of the macroblock of the forward predictive encoded picture, and the encoding module includes a variable length encoder to subject each macroblock of each of the pictures to variable length encoding.

5           5. A video encoding mode converting apparatus comprising:

10           an encoding mode conversion module configured to convert first encoded video data of a first encoding mode into second encoded video data of a second encoding mode, the first encoded video data and the second encoded video data each including an intraframe encoded picture, a forward predictive encoded picture and a bidirectional predictive encoded picture; and

15           an encoding module configured to skip a macroblock of the forward predictive encoded picture of the second encoding mode that satisfies following conditions:

20           (a) all macroblocks of all bidirectional predictive encoded pictures subjected to a forward motion vector detection referring to a reference picture used for the forward predictive encoded picture, the all macroblocks being located at the same position as that of the forward encoded picture are skipped, or

(b) forward motion vectors of the all macroblocks corresponding to the same position are 0, and the number of blocks making the macroblock and changing with respect to the reference picture is 0.

5       6. A video encoding mode converting apparatus according to claim 5, which includes:

10      an input module to input encoded data of a first encoding mode including an intraframe encoded picture and a forward predictive encoded picture and a bidirectional predictive encoded picture;

15      an information acquirement module configured to acquire information representing a motion vector, an encoding mode and the number of blocks making the macroblock and changing with respect to a macroblock of a reference picture; and

20      a mode determination module configured to determine an encoding mode of each macroblock that satisfies the conditions (a) and (b) when encoding each macroblock in the second encoding mode according to the information representing the motion vector and the encoding mode.

7. A video encoding mode converting apparatus comprising:

25      a decoder to decode encoded data of a first encoding mode including an intraframe encoded picture, a forward predictive encoded picture and a bidirectional predictive encoded picture to output

decoded data;

a mode determination module configured to determine an encoding mode of each macroblock when encoding each macroblock in a second encoding mode  
5 according to information obtained from the decoder, the information representing a motion vector, an encoding mode and the number of macroblocks changing with respect to a reference picture; and

10 a variable length encoder to encode picture data provided from the decoder in the second encoding mode every macroblock according to a determination result of the mode determination module,

15 the mode determination module determining to skip the macroblock of the forward prediction encoded picture in the second encoding mode according to following conditions:

(a) macroblocks of all bidirectional predictive encoded pictures encoded based on forward motion compensation referring to the same reference picture as that used for the forward predictive encoded picture,  
20 the macroblocks located at the same position as that of the reference picture, are skipped, or

25 (b) all forward motion vectors of macroblocks corresponding to the same position and the number of blocks having orthogonal-transformed coefficients are 0.

8. A video encoding mode converting apparatus

comprising:

a mode converter to convert video encoded data of a MPEG-2 mode into video encoded data of a MPEG-4 mode; and

5 an encoder to encode a macroblock of a P-Picture in not\_coded mode when satifying conditions (a) or (b) in the MPEG-4 mode,

10 (a) macroblocks of all B-Bictures encoded based on forward motion compensation referring to the P-Picture, the macroblocks located at the same position as that of the P-Picture, are skipped,

15 (b) all the forward motion vectors and CBPs of macroblocks of all the B-Pictures forwardly referring to the same reference picture as that used for the P-Picture are 0.

9. A video encoding method of subjecting a video to intraframe encoding, forward predictive encoding, and bidirectional predictive encoding, comprising:

20 detecting a motion vector of an input picture in units of a macroblock by block matching referring to a reference picture; and

25 performing the forward predictive encoding and bidirectional predictive encoding in units of a macroblock using the motion vector and the reference picture, to generate a forward predictive encoded picture and at least one bidirectional predictive encoded picture which is inputted between the forward

predictive encoded picture and the reference picture,  
the predictive encoding module skipping a macroblock of  
the forward predictive encoded picture in a variable  
length encoding when a correlation between the  
5 macroblock of the forward predictive encoded picture  
and macroblocks of the bi-directional predictive  
encoded picture and the reference picture which are  
located at the same position as that of the forward  
predictive encoded picture is high.

10       10. A video encoding method of encoding an input  
video signal, the method comprising:

detecting a forward motion vector every macroblock  
of a to-be-encoded picture using as a reference picture  
an intraframe encoded picture or a first forward  
15 encoded picture just before the to-be-encoded picture  
to generate a second forward predictive encoded picture  
and bidirectional predictive pictures;

subjecting pixel values of the macroblock of the  
to-be-encoded picture to an orthogonal transformation  
20 every macroblock and quantizing the orthogonal-  
transformed coefficients;

skipping the macroblock of each of the forward  
predictive encoded picture and the bidirectional  
predictive encoded pictures in a variable length  
25 encoding when satisfying following conditions:

(a) a forward motion vector of the macroblock of  
the bidirection predictive encoded picture that is

located at the same position as the macroblock of  
the to-be-encoded picture is 0, the bidirectional  
predictive encoded picture subjected to a motion vector  
detection using the same reference picture as that used  
5 for the to-be-encoded picture, and

(b) differences between macrblocks of all the  
bidirectional predictive encoded pictures as that of  
the reference picture and the macroblock of the  
reference picture are not more than a threshold.

10 11. A video encoding mode converting method  
comprising:

converting video encoded data of a MPEG-2 mode  
into video encoded data of a MPEG-4 mode; and

15 skipping a macroblock of a forward predictive  
encoded picture when satifying conditions (a) or (b) in  
the MPEG-4 mode,

20 (a) macroblocks of all B-Bictures encoded based on  
forward motion compensation referring to the P-Picture,  
the macroblocks located at the same position as that of  
the P-Picture, are skipped,

(b) all the forward motion vectors and CBPs of  
macroblocks of all the B-Pictures forwardly referring  
to the same reference picture as that used for the  
P-Picture are 0.

25 12. A video encoding apparatus comprising:  
an intraframe encoding module;  
a forward predictive encoding module;

a bidirectional predictive encoding module;  
an information extracting module configured to  
extract specific information from an encoded result of  
a first picture encoded by one of the intraframe  
5 encoding module, the forward predictive encoding module  
and the bidirectional predictive encoding module; and  
a selection module configured to select, according  
to the specific information, one of the intraframe  
encoding module and the forward predictive encoding  
10 module, to encode a second picture to be encoded next  
to the first picture.

13. The video encoding apparatus according to  
claim 12, wherein the selection module selects one of  
the intraframe encoding module and the forward  
15 predictive encoding module in following cases:

- (a) the first frame is encoded by the forward  
predictive encoding module, and
- (b) the first frame is encoded by the  
bi-directional encoding module and a third picture  
20 inputted next to the first picture is encoded by the  
forward predictive encoding module.

14. The video encoding apparatus comprising:  
an intraframe encoding module;  
a forward predictive encoding module;  
25 a bidirectional predictive encoding module;  
a computation module configured to compute the  
number of encoded bits obtained by encoding a first

picture with one of the intraframe encoding module,  
the forward predictive encoding module and the  
bidirectional predictive encoding module;

a threshold memory to store a threshold;

5           a selection module configured to select one of the  
intraframe encoding module and the forward predictive  
encoding module, to encode a second picture to be  
encoded next to the first picture when the number of  
encoded bits of the first picture is more than the  
10          threshold.

15.       The video encoding apparatus according to  
claim 14, wherein the control module includes a first  
setting unit configured to set a first value to the  
threshold memory when the number of encoded bits of the  
first picture is more than the threshold, and

a second setting unit configured to set a second  
value more than the first value to the threshold memory  
when the number of encoded bits of the first picture is  
less than the threshold.

20       16.   The video encoding apparatus according to  
claim 14, wherein the selection module selects one of  
the intraframe encoding module and the forward  
predictive encoding module in following cases:

25       (a) the first frame is encoded by the forward  
predictive encoding module, and

         (b) the first frame is encoded by the  
bi-directional encoding module and a third picture

inputted next to the first picture is encoded by the forward predictive encoding module.

17. A video encoding apparatus comprising:

an encoding module configured to encode a video by  
5 using intraframe encoding mode, forward predictive encoding mode and bi-directional predictive encoding mode;

10 a computation module configured to compute the number of encoded bits of a code obtained by encoding the video by the encoding module; and

a presuming module configured to presume a occupancy of a VBV buffer by using the number of encoded bits, the VBV buffer being a virtual buffer of a virtual decoder side; and

15 a selection module configured to select one of the intraframe encoding mode and the forward predictive encoding mode for a second picture to be encoded next to the first picture according to the occupancy of the VBV buffer.

20 18. The video encoding apparatus according to claim 17, wherein the selection module selects the intraframe encoding mode and the forward predictive encoding mode when the occupancy of the VBV buffer is less than the threshold.

25 19. The video encoding apparatus according to claim 17, wherein the selection module selects the intraframe encoding mode and the forward predictive

encoding mode when the occupancy of the VBV buffer decreases over the first picture and a plurality of pictures before the first picture.

20. The video encoding apparatus according to  
5 claim 17, wherein the selection module selects one of the intraframe encoding mode and the forward predictive encoding mode when the result of encoding of the first picture is skipped.

21. The video encoding apparatus according to  
10 claim 17, wherein the selection module selects one of the intraframe encoding mode and the forward predictive encoding mode when the number of encoded bits of a motion vector of encoded data of the first picture exceeds a threshold.

15 22. The video encoding apparatus according to  
claim 17, which includes an examination module configured to examine a computation load of the encoding module, and the selection module selects one of the intraframe encoding mode and the forward predictive encoding mode when the computation load exceeds a threshold.  
20

25 23. The video encoding apparatus according to  
claim 17, wherein the selection module selects one of the intraframe encoding mode and the forward predictive encoding mode in following cases (a) and (b):

(a) the first frame is encoded by the forward predictive encoding mode, and

(b) the first frame is encoded by the bi-directional encoding mode and a third picture inputted next to the first picture is encoded by the forward predictive encoding mode.

5        24. A video encoding method comprising:  
              encoding each picture of a video;  
              extracting a specific information from an encoded  
result obtained by encoding a first picture; and  
              selecting one of a forward predictive encoding  
10      mode and an intraframe encoding mode according to the  
information in encoding a second picture to be encoded  
next to the first picture.

15      25. The video encoding method according to  
claim 24, wherein the selecting selects one of  
a forward predictive encoding mode and an intraframe  
encoding mode in following cases (a) and (b):

20      (a) the first frame is encoded by the forward  
predictive encoding mode, and  
              (b) the first frame is encoded by the  
bi-directional encoding mode and a third picture  
inputted next to the first picture is encoded by the  
forward predictive encoding mode.

25      26. A video encoding method comprising:  
              encoding each picture of a video;  
              deriving the number of encoded bits generated when  
encoding a first picture;  
              comparing the number of encoded bits of the first

picture with a threshold;

selecting one of an intraframe encoding mode and  
a forward predictive encoding mode for a second picture  
to be encoded next to the first picture when the number  
5 of encoded bits of the first picture exceeds the  
threshold.

27. The video encoding method according to  
claim 26, which includes setting a first value as  
the threshold for next comparison when the number  
10 of encoded bits of the first picture exceeds the  
threshold; and setting a second value larger than the  
first threshold as the threshold for next comparison  
when the number of encoded bits of the first picture is  
less than the threshold.

15 28. The video encoding method according to  
claim 26, wherein the selecting selects one of  
a forward predictive encoding mode and an intraframe  
encoding mode in following cases (a) and (b):

(a) the first frame is encoded by the forward  
20 predictive encoding mode,  
(b) the first frame is encoded by the bi-  
directional encoding mode and a third picture inputted  
next to the first picture is encoded by the forward  
predictive encoding mode.

25 29. A video encoding method comprising:  
encoding each picture of a video;  
computing the number of encoded bits when encoding

a first picture;

presuming occupancy of a VBV buffer that is  
a virtual buffer of a virtual decoder side by using the  
number of encoded bits, the VBV buffer being a virtual  
5 buffer on a virtual decoder side; and

selecting one of an intraframe encoding mode and  
a forward predictive encoding mode for a second picture  
to be encoded next to the first picture, according to  
a change of the occupancy of the VBV buffer.

10 30. The video encoding method according to  
claim 29, wherein the selecting selects one of the  
intraframe encoding mode and the forward predictive  
encoding mode when the occupancy of the VBV buffer is  
less than the threshold.

15 31. The video encoding method according to  
claim 29, wherein the selecting selects one of the  
intraframe encoding mode and the forward predictive  
encoding mode when the occupancy of the VBV buffer  
decreases over the first picture and a plurality of  
20 pictures before it.

32. The video encoding method according to  
claim 29, wherein the selecting selects one of the  
intraframe encoding mode and the forward predictive  
encoding mode when a result obtained by encoding the  
25 first picture is "not\_coded".

33. The video encoding method according to  
claim 29, wherein the selecting selects one of the

intraframe encoding mode and the forward predictive encoding mode when the number of encoded bits of a motion vector of encoded data of the first picture exceeds a threshold.

5       34. The video encoding method according to claim 29, which includes examining a computation load of the encoding, and the selecting selects one of the intraframe encoding mode and the forward predictive encoding mode when the computation load exceeds the  
10 threshold

35. The video encoding method according to claim 29, wherein the selecting selects one of a forward predictive encoding mode and an intraframe encoding mode in following cases (a) and (b):

15       (a) the first frame is encoded by the forward predictive encoding mode,  
            (b) the first frame is encoded by the bi-directional encoding mode and a third picture inputted next to the first picture is encoded by  
20 the forward predictive encoding mode.

36. A video encoding apparatus to encode a video by MPEG-4, comprising:

an encoding module configured to encode each VOP (video object plane) of the video;  
25       an extraction module configured to extract specific information from an encoded result of a first VOP of the video;

a control module configured to control the  
encoding module to encode a second VOP to be encoded  
next to the first picture as one of an intraframe  
encoded picture, a forward predictive encoded picture  
5 and a not\_coded picture, according to the specific  
information.

37. A video encoding apparatus to encode a video  
by MPEG-4, comprising:

an encoder to encode each VOP (video object plane)  
10 of the video;

a computation module configured to obtain the  
number of encoded bits generated by encoding a first  
VOP of the video;

15 a memory to store a threshold; and  
a control module configured to compare the number  
of encoded bits of the first VOP with the threshold,  
and control the encoder to encode a second VOP to be  
encoded next to the first VOP as one of an intraframe  
encoded VOP, a forward predictive encoded VOP and  
20 a not\_coded VOP when the number of encoded bits exceeds  
the threshold.

38. A video encoding apparatus to encode a video  
by MPEG-4, comprising:

an encoder to encode each VOP (video object plane)  
25 of the video;

a computation module configured to obtain the  
number of encoded bits generated by encoding a first

VOP of the video;

a presume module configured to presume occupancy of a VBV buffer that is a virtual buffer of a virtual decoder side by using the number of encoded bits;

5           a control module configured to control the encoder to encode a second VOP to be encoded next to the first VOP as one of an intraframe encoded VOP, a forward predictive encoded VOP and a "not\_coded" VOP, according to a change of the occupancy of the VBV buffer.

10          39. A video encoding method comprising:

encoding each picture of a video by MPEG-4;  
extracting specific information from a result obtained by encoding a first VOP (video object plane) of the video; and

15          encoding a second picture to be encoded next to the first picture as one of a forward predictive encoded VOP, an intraframe encoded VOP and a not\_coded VOP, according to the specific information.

40. A video encoding method comprising:

20          encoding each picture of a video by MPEG-4;  
computing the number of encoded bits generated when encoding a first VOP (video object plane);  
comparing the number of encoded bits of the first VOP with a threshold;

25          controlling the encoding to encode a second VOP to be encoded next to the first picture as one of a forward predictive encoded VOP, an intraframe encoded

VOP and a not\_coded VOP, when the number of encoded bits of the first VOP exceeds the threshold.

41. A video encoding method comprising:

encoding each VOP (video object plane) of a video  
5 by MPEG-4;

computing the number of encoded bits generated when encoding a first picture;

presuming occupancy of a VBV buffer that is a virtual buffer of a decoder side, by using the number  
10 of encoded bits,

controlling the encoding to encode a second VOP to be encoded next to the first VOP as one of a forward predictive encoded VOP, an intraframe encoded VOP and a not\_coded VOP, according to a change of the occupancy  
15 of the VBV buffer.